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THE

Farmer and Gardener's DIRECTORY,

CONTAINING THE MOST APPROVED

RULES AND DIRECTIONS

FOR

Foretelling the Changes,

WHICH TAKE PLACE IN THE

WEATHER;

WITH

OBSERVATIONS

ON THE

Barometer, Thermometer, Hygrometer,

AND

RAIN-GUAGE.

THIRD EDITION.

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ADVERTISEMENT.

THERE is scarcely any subject in which mankind feel themselves more interested than in the state of the weather, and to those who spend a great part of their time in the open air, it is of the utmost consequence; no wonder, therefore, that it has engaged the attention of mankind in all ages: but such facts as have been discovered, are in general so blended with the mass of absurd notions, which the mysterious and specious art of astrology has imposed upon the world, that it requires great care and industry to separate them.

In a science so very difficult, and still in its infancy, it is not to be supposed that any thing like a certain theory can at this time be laid down. Of late years, however, it seems to have obtained due consideration from all the learned Societies in Europe, who have made it a part of their labours; and many eminent individuals are endeavouring also to remove the veil with which it is covered. We *have, therefore, reason to hope that improvements will be made; and the more we become acquainted with the constitution of the atmosphere, with the nature of those powerful agents, by which it appears to be principally influenced, and with their peculiar modes of operation and action upon one another, the nearer it will arrive at perfection.*

Till this is accomplished, we must still be guided by such principles and facts as we now possess; and of these, the greatest part is not so generally known as it ought to be. The Editor has, therefore, brought together the best and most esteemed rules, observations, and remarks, that are considered as indications of good and bad weather, and arranged them under proper heads, for the use and information of those, who feel themselves interested in predictions of this kind; which he now offers to the public, and hopes they will not be deemed useless, particularly as rules of this nature have always been, and will be resorted to, till meteorology is brought to a greater degree of certainty.

THE
Farmer & Gardener's
DIRECTORY.

Signs from Animals, &c.
INDICATING
A CHANGE IN THE WEATHER.

IT is generally allowed, that Animals have their organized fluids and solids better constituted, are more susceptible of the variations produced in the atmosphere, and exhibit signs of them, much sooner than Man. From the many predictions displayed by this part of the creation, the following are selected as the most common and obvious to our senses.

The croaking of *Crows* in the morning indicates a fine day.

When *Fowls* roll in the dust and sand, more than usual, it announces rain.

When *Ducks* and *Geese* fly forwards and backwards, and wash themselves more than usual, it indicates rain, and stormy weather.

Dogs grow stupid and sleepy before rain, and shew that their stomachs are affected, by refusing their food and eating grass.

When the *Swallows* fly high after their prey, we think ourselves sure of a serene sky; but when they fly low, and brush the surface of the water with their wings, we judge that rain is not far off.

Before rain and wind, *Swine* discover great uneasiness; as do *Oxen*, *Cows*, and *Sheep*, appearing more desirous of feeding in their pastures than usual, and seem to quit them with reluctance.

The weather is about to become cloudy, and to change for the worse, when the *Flies* sting, and become more troublesome than usual.

When the *Gnats* collect themselves, before the setting of the sun, and form a sort of vortex, in the shape of a column, it announces fine weather.

If the *Bees* continue near their hives, it indicates rain; and if they return to them, before the usual time, it may be concluded, that it will soon fall.

If *Pigeons* return slowly to the pigeon house, it indicates that the succeeding days will be rainy.

When *Sea Fowl* and other *Aquatic Birds* retire to the sea shore, or marshes, it announces a change of weather, and a sudden storm.

The appearance of *Birds of Passage* early in autumn, announces a severe winter; for it indicates that it has already begun in the Northern countries.

When the *Bats* remain longer than usual abroad, fly about in greater numbers, and at a greater distance than common from their holes, it announces that the following day will be warm and serene.

Before rain *Moles* work harder than usual, throw up more earth, and sometimes come forth.

If the *Redbreast* sings from the higher branches of a tree in the morning, it indicates a fine day.

Before rain, *Ants* are observed to bustle about and remove their eggs from their small hills and then retire.

If *Frogs* and *Toads* issue from their holes in the evening, in great numbers, and *Spiders* are seen crawling on the walls, &c. rain may soon be expected.

When *Spiders' Webs*, and the *Leaves of Trees*, are agitated without any appearance of wind, it denotes wind and perhaps rain ; because it shews, that strong and penetrating exhalations arise from the earth.

The hollow sound of *Forests*, the murmuring noise of the waves of the *Sea*, their foaming, and their green and black colour, indicate a storm.

If the sound of *Bells* is heard at a great distance, it is a sign of wind, or a change in the weather.

If the flame of a *Candle* or *Lamp* crackles or flares, it indicates rainy weather.

When the *Coals* seem hotter, and their flame more agitated than usual, though the weather be calm, it indicates wind. But when the flame burns steadily and proceeds straight upwards, it is a sign of fine weather.

When *Walls*, *Flag-Stones*, *Salt*, &c. become moist, it indicates, that aqueous vapours are exhaled from the earth, and, directed by the electric matter, (which diffuses itself at that time in greater abundance) adheres to, and penetrates every substance: the consequence of which is rain.

When *Stones*, *Salt*, &c. after being moist, become dry, it is a sign of fine weather.

When the weather inclines to rain, the water in *Basons*, *Pails*, *Tubs*, &c. is seen to diminish ; because

cause the humidity is then carried away by the evaporation of the electric matter from the earth.

The *Earth*, after very long and abundant rain, is sometimes seen to be almost dry, and the *Roads* quite free from dirt. This is a sign, that the rain has not altogether ceased; and denotes a continual efflux of electric matter, which, being renewed, carries with it, in the form of vapour, all the moisture, that falls on the earth.

There is sometimes a great deal of *dirt* after a very moderate rain: this is a sign of fine weather; because it indicates that evaporation has ceased.

Dry Stones and *Moist Earth*, announce fine weather; and on the contrary, *Dry Earth* and *Moist Stones* indicate rain.

SIGNS

FROM

Vapours, Clouds, &c.

INDICATING

A CHANGE IN THE WEATHER.

THE heat of the sun, together with that of the electrical matter, which flows from the earth, appears to be the principal cauſe of what is called spontaneous evaporation; or an insensible dissipation of the humidity of every substance on the surface of the earth, in fume or vapour, which rises into the atmosphere, and is there formed into mists, fogs, clouds, and other atmospherical phænomena. From the different appearances, &c. of these, the following Signs, indicating a Change in the Weather, are selected.

In a morning, if a *Mist*, which hangs over the lowlands, draws towards the highlands, it indicates a fine day.

If a *White Mist*, in the evening, is spread over a meadow, wherein there is a river, it will be drawn up by the sun of the next morning, and the day will be bright afterwards.

After the atmosphere has taken up three or four *fogs*, it is pretty sure to send them down again in rain.

If the *Dew* lies plentifully upon the grass, after a fine day, another fine day may be expected; but if, after such a fair day, there is no dew, nor wind stirring, it is a sign, that the vapours go upwards, and there will be an accumulation above, which will terminate in rain.

When a strong hoar frost is seen on the ground in the morning, during winter, it will not fail to rain the second or third day after, at farthest.

When *Clouds* appear to lessen by degrees, and melt into the air, till they are no longer visible, it is a sign of fine weather.

When the sky, which has long been serene and blue, besomes fretted and spotted with many *small clouds*, bearing some resemblance to the waves of the sea, it indicates rain.

Against heavy rains, every *Cloud* rises bigger than the former, and all are in a growing state.— This is most remarkable on the appearance of a thunder-storm.

When the *Clouds* are formed like fleeces, deep and dense towards the middle, and very white at the edges, with the sky very bright and blue about them, they are of a frosty coldness, and will soon fall either in hail, snow, or in hasty showers of rain.

If *Clouds* are seen high in the air, in thin white trains, like locks of wool, or the tails of horses, they shew, that the vapours are spread and scattered by contrary winds above; the consequence of which will soon be a wind below, and probably rain with it.

When a *general Cloudiness* covers the sky above, and there are small black fragments of clouds, like smoke, flying underneath, rain is not far off, and it will probably be lasting.

There is no surer sign of rain, than two different *Currents of Clouds*, especially if the under current flies fast before the wind. And if two such currents appear in hot weather, they shew, that a thunder storm is gathering.

A *Venetian Proverb* says, that a sudden storm from the North does not last three days.

It is a bad symptom, when a lowering redness is spread too far upwards in the horizon, either in the morning or the evening; because it is generally succeeded either by rain or wind, and frequently by both.

When the sky, in a very rainy season, is tinged with a *Sea Green Colour*, near the bottom, where it ought to be blue, the rain will continue and increase; if it is of a deep dead blue, it shews, that it is abundantly loaded with vapours, and the weather will be showery.

When there is a *Haziness* in the air, so that the sun's light fades by degrees, and looks white, it is one of the surest signs of rain. And if the moon and stars grow dim in the night, with a like haziness in the air, and a *Ring* or *Burr* appears round the moon, rain will be the consequence.

If the *Rays of the Sun*, breaking through the clouds, are visible in the air, it is a sign, that the air is filled with vapours, which will soon produce rain.

If the *Sun appears white* at his setting, or goes down into a bank of clouds, which lie in the horizon, they are signs of approaching or continuing bad weather.

Clouds of similar appearance produce thunder in summer, and snow in winter: such clouds are broken, and irregularly shaped, and from their uncommon density, project towards the earth.

Thunder is generally preceded by hot weather, and followed by cold and showery weather.

After a *Thunder Storm*, if it has been of considerable duration, the wind generally veers to the quarter whence the first clap proceeded.

A frequent change of *Wind*, accompanied with an agitation of the clouds, denotes a sudden storm.

When the *Wind veers about* uncertainly to several points of the compass, rain is pretty sure to follow.

If, after a *continual Rain* from a muddy sky, the horizon appears light in any quarter, expect wind from that quarter.

The heaviest rains, when of long continuance, generally begin with the wind blowing Easterly, and gradually veers round to the South, and the rain does not cease till the wind has got to the West, or rather a little to the Northward of the West.

When the *Wind* blows over a large space of country, drenched with water, or covered with snow, from the great evaporation thereby occasioned, a much greater degree of cold is soon produced.

A *whistling* or *howling Noise* of the *Wind* announces rain: the South West wind is most apt to have this effect, because it brings with it a great quantity of moist vapours.

The *North Wind* is the coldest; because it comes from the Frigid Zone. The *South Wind* is the warmest; because it comes from the Torrid Zone, over countries hotter than our own. The *East Wind* is the driest; because it comes across the vast continent of Asia, but little watered by rivers, or seas. And the *West Wind* is generally damp, and often blows us rain; because it crosses the great Atlantic Ocean, and attracts a great quantity of vapours.

A *Fresh Breeze* generally springs up before sunset, especially in summer.

A *Rainbow* in the morning is the shepherd's warning; but a *Rainbow* at night is the shepherd's delight.

When it rains with an *East Wind*, it will probably rain for 24 hours.

Violent Winds generally abate towards Sun-set.

The weather generally clears at *Noon;* but when it rains at *Midnight*, it seldom clears up again till Sun-set.

When the *Wind* follows the course of the sun, it is attended with fair weather.

Violent Winds are more prevalent in the neighbourhood of mountains, than in the open plains.

When a North-west and a South-east wind prevail together, at two different heights in the atmosphere, if the South-east be the lower one, we may expect to see the weather become clear; but if this wind be the higher, the contrary will take place,

When an *Aurora Borealis* appears after some warm days, it is generally succeeded by a coldness of the air.

Those *Meteors*, which fly along with a train of fire, and are called *shooting stars*, are supposed to shew that wind is impending.

When an *Aurora Borealis* has been considerable, either bodies of clouds are formed, or else a greater degree of cold is immediately produced.

The *quicker the streamers* are in their motion, and the more they appear to the Southward of the Zenith, the sooner will a heavy body of clouds be formed, and in all probability a fall of rain, &c. ensue.

When an *Aurora Borealis* has been very considerable in quickness, and appears to the Southward of the Zenith, as to extent and duration; the clouds begin to form with a precipitating appearance, generally in 24 hours after, and the rain will take place mostly before the end of 36 hours.

When the *Streamers* are of a deep orange or red colour, steady in their appearance, and confined to the north or easterly points of the horizon, there is reason to expect a wind from those points, and one or two days of dry weather, before any fall of rain.

Light or *Pale Streamers* are a probable sign of a south or westerly wind, with a quick formation of clouds, &c. and when they appear in all parts of the hemisphere, moving quickly with vivid colours, it is a sign of strong winds, or of showers accompanied with gusts of wind.

During the time of rain, if any small space of the sky be observed, we may almost be assured that the rain will not be of long duration: this sign is well known to Huntsmen.

If the clouds which move with the wind, become stationary when they arrive at that part of the horizon opposite to the wind, and seem to accumulate, it is a sign that rain will soon fall.

Very violent storms, when accompanied with earthquakes, are almost always preceded by an extraordinary calm in the air; at which time the mercury in the barometer falls very low.

SIGNS

OF

Wet and Dry Seasons, &c.

AS the cause of every change in the weather must have preceded for some time the effect; it is therefore, in general, by an attention to its previous state, that we are enabled to form the most accurate judgment of what weather is to be in future expected. And from a series of observations of this kind, made by KIRWAN, TOALDO, COTTE, and others, for a great length of time, the following Rules and Remarks are selected.

A *Day* is accounted *Wet*, when rain falls to the amount of one pound troy, on the space of a square foot. A *Week*, when it contains four or more wet days. A *Month*, when it contains three wet weeks. And a *Season*, or *Quarter of a Year*, when it contains two wet months.

When there has been no storm, before or after the *Vernal Equinox*, the ensuing summer is generally *Dry*, at least five times in six.

When a storm happens from the east, either on the 19th, 20th, or 21st of March, the succeeding summer is *Dry*, four times in five.

When a storm arises on the 25th, 26th, or 27th of March, and not before, in any point, the succeeding summer is generally *Dry*, four times in five.

If there should be a Storm at south-west, or west south-west, on the 19th, 20th, 21st, or 22d, the succeeding summer is generally *Wet*, five times in six.

It rains less in March than in November, in the proportion of seven to twelve.

It generally rains less in April than in October, in the proportion of one to two. And less in May than in September, in the proportion of three to four.

When it rains plentifully in May, it generally rains but little in September; and the contrary.

Out of forty-one years, there will in general be twenty-two dry *Springs*, six wet, and thirteen variable ones; also twenty wet *Summers*, sixteen dry, and five variable ones; and probably eleven dry *Autumns*, eleven wet, and nineteen variable ones.

The quantity of rain which falls in nine successive years, is nearly equal to that which falls in the next following nine.—And every nineteenth year is generally similar.—This similarity was very striking between the temperature of the years 1701, 1720, 1739, 1758, and 1777.

A great quantity of *Snow in Winter*, promises a fertile year; but abundant rains, give reason to apprehend that it will be barren.

A winter, during which a great deal of snow and rain fall, announces a warm summer.

It is generally believed that *Thunder in Winter* prognosticates abundance, because it fertilizes the earth.

If the summer be remarkably rainy, it is probable that the ensuing winter will be severe; for the unusual evaporation will have carried off the heat of the earth. Wet summers are generally attended with an unusual quantity of seed on the *White Thorn* and *Dog-rose Bushes*: hence the unusual fruitfulness of these shrubs is a sign of a severe winter.

When the wind is south-west during summer or autumn, and the temperature of the air unusually cold for the season, much rain is expected.

A *Moist Autumn* with a mild winter is generally followed by a cold and dry spring, which greatly retards vegetation: such was the year 1741.

A long severity of seasons, either by winds, drought, dampness, heat or cold, becomes exceedingly destructive to plants and animals.

A damp spring or summer, is commonly followed by a fine autumn.

If the winter is rainy, the spring will in general be dry; and if the former is dry, the latter will be damp.

When the autumn is fine, it announces a winter, during which winds will prevail, and the spring will be rainy.

It rains oftener in the day time than in the night; and oftener in the evening than in the morning.

Unusual Cold in Summer is produced from the long continuance of easterly or northerly winds; from frequent and heavy rains; and from a long continuance of cloudy weather, which prevents the earth from receiving a proper proportion of heat from the sun.

Unusual Cold in Winter commonly happens from unusual cold or wet in the preceding summer; from the immediate effect of heavy rains, followed by easterly or northerly winds; and from westerly or southerly currents in the upper regions of the atmosphere, while east or north winds prevail near the surface of the earth.

The following years were remarkable for the intenseness of the frost, viz. 1507, 1522, 1608, 1638, 1655, 1657, 1663, 1670, 1677, 1699, 1740, 1776, 1788, and the winter of 1798-9, in which the cold was very severe.

At the time of the equinoxes, or when the sun passes from one hemisphere into the other, there is generally some disturbance in the weather, particularly with respect to the winds, which at, or near, those times, are higher and more boisterous than usual.

The summer solstice, or about the 20th of June, is frequently distinguished by violent rains, called *Midsummer Floods.* And the winter solstice or about the 20th of December, is the time that the severe frosts set in, with some continuance of snow, which lies long upon the ground.

THE

Influence of the Moon

ON THE WEATHER.

AS the Moon's influence on the water of the ocean, in producing the tides, is now universally acknowledged, and rationally accounted for, we may therefore reasonably conclude, that it has a similar effect on the atmosphere, as being a gravitating fluid, differing in a physical sense from water, chiefly in possessing less gravity. And this idea promises at length to obtain due consideration and support, from the sure principles of the Newtonian philosophy; as is evident by the labours of Toaldo, Lamarck, & Howard. It is very easy to conceive, that in consequence of the lunar influence, great variations and commotions must take place in the atmosphere,

phere, and also in the weather; which agree with the observations of TOALDO, who has compared the state of the atmosphere with the different situations and aspects of the Moon in her monthly revolutions, and found that good and bad weather may be very often truly predicted by them. It is therefore, chiefly from this source that the following directions are selected.

* * *

The probability, that the weather will change at, or near, the *New Moon*, is as 6 to 1.—At the *first Quarter*, as 5 to 2.—At the *Full*, as 5 to 2.—And at the *last Quarter*, as 5 to 4. That is, a person may venture to bet 6 to 1, that the new moon will bring with it a change of weather.

The probability that the weather will change at, or near, the time when the moon, in each lunation, approaches as near as she can to the Zenith, is as 11 to 4; and at her greatest distance from it, in each lunation, as 3 to 1.

The probability, that the weather will change at, or near, the time when the moon passes over the Equator, if ascending to the Northern hemisphere, is as 13 to 4; and in her descending to the Southern hemisphere, as 11 to 4.

The probability, that the weather will change at, or near the time when the moon is at her greatest distance from the earth in each lunation is as four to one; and at her least distance from it, as seven to one.

When a combination of any of these situations of the moon takes place, it generally occasions storms and tempests; and this perturbating power will always have the greatest effect, the nearer they are to the moon's passage over the equator, particularly in the months of March and September.

The situations of the moon, favourable to *Good Weather*, are its greatest distance from the earth, its quadratures, and its greatest distance from the zenith: and for *Bad Weather*, are its nearest distance to the earth, new and full moons, passage of the equator, and its least distance from the zenith.

Each situation of the moon alters that state of the atmosphere which has been occasioned by the preceding one; and it seldom happens that any change in the weather takes place without a change in the lunar situations.

Changes of the weather seldom take place on the very days of the moon's changing, but either precede or follow, viz. such as happen in the six winter months generally precede; and those in the six summer months follow them.

On the 4th day before new and full moon, the weather is inclined to change. If, on these days, the horns of the moon are clear and well defined, good weather may be expected. But if they are dull and not clearly marked on the edges, bad weather will ensue.

When the weather remains unchanged, on the 4th, 5th, and 6th days of the moon, we may conjecture, that it will continue so till full moon and sometimes till the next new moon.

If the moon is rainy throughout, it generally clears up at the ensuing change, and the rain will probably commence in a few days after, and continue. But, if the moon has been fair throughout, and it rains at the change, the fair weather will probably be restored, about the 4th or 5th day of the moon, and continues as before.

Note.—By these directions, *Mr. Jones*, in his *Physiological Disquisitions*, says, he has made hay for twenty years, without having once had the mortification to see it damaged by rain.

If the moon looks pale or dim, we are to expect rain.—If red, it is a sign of wind.—If white, and of its natural colour, we may expect fair weather.

In rainy days, the bad weather is generally a little interrupted about the time the moon passes the meridian.

The eclipses of the sun and moon generally occur in the midst of good weather.

The great falls of rain and stormy weather generally take place on the 3d or 2d days before, or three, four, or five days after the change and full of the moon, and not at the precise time that they happen.

The times most exposed to rain are the rising and setting of the moon: and those most favourable to good weather, are its passage over the meridian.

It is supposed that the general temperature, or state of the weather of any year, will nearly correspond with each antecedent 19th year; because the phases and positions of the moon in regard to the earth, are again the same.

It is well known that the *Full Moon* nearest the 23d of September, during the week in which it is full, rises sooner after sun-set than any full moon week in the year. By this means it affords an immediate supply of light after sun-set, to enable the *Farmer* to gather in his corn.—Hence this moon is called the *Harvest Moon*, and is in some years more beneficial to the farmer than in others. In

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the former case, the time of its rising after sunset does not exceed 1⅔ hours for 7 days together; whilst in the latter case there is a difference of 3½ hours in the same space of time. And these variations of the moon's rising are gone through every 19 years.

The following account shews what years the harvest moon will be of most benefit to the farmer, and what years it will not, viz.

From the year 1800 to 1806 inclusive, most beneficial.

From 1807 to 1815 inclusive, least beneficial.

From 1816 to 1825 inclusive, most beneficial.

From 1826 to 1834 inclusive, least beneficial.

From 1835 to 1843 inclusive, most beneficial.

From 1844 to 1852 inclusive, least beneficial.

And from 1853 to 1861 inclusive, most beneficial.

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SIGNS

Signs from the Barometer,

INDICATING

A CHANGE IN THE WEATHER.

THE greatest acquisition, perhaps, that ever was made to natural philosophy, with respect to ascertaining the changes of the weather, was the discovery of the Barometer, although it is not considered as an infallible guide in this respect. From some observations lately made by Mr. HOWARD, and others, there is great reason to suppose that the Moon has some influence on the state of the Barometer, which may lead to several important consequences, amongst which, perhaps, to a new and more satisfactory theory of this instrument; by which means, it may be still more successfully applied to foretel the changes which take place in the weather.—The usual ranges of the Mercurial Column in our latitude, are comprehended between twenty-eight and thirty-one inches; of which the middle, or twenty-nine and a half inches is the uſual station in variable weather, when there is a mixture of showers and sun-shine: and accordingly as it deviates from this point, we foretel the changes that are likely to take place in the atmosphere, by the following rules and directions.

* * *

When the mercury falls in the *Barometer*, it announces *Rain* or *Wind*, or in general what is called *Bad Weather*. And on the contrary when it rises it announces *Fair Weather*.

When the mercury falls in frosty weather, either *Snow* or a *Thaw* may be expected: but if it rises in the winter with a north or east wind, it generally forebodes a *Frost*.

If the mercury sinks slowly, we may expect *Rain*, which will probably be of some continuance. But if it rises gradually, we may expect *Fine Weather*, that will be lasting.

When the Barometer is fluctuating, rising and falling suddenly, the weather may be expected to be like it, *changeable*.

When the mercury falls very low, there will be much rain. But if its fall is low and sudden, a *High Wind* frequently follows.

When an extraordinary fall of the mercury happens, without any remarkable change near at hand, there is some probability of a storm at a distance.

In very hot weather, the fall of the mercury indicates *Thunder*.

The Barometer will descend sometimes as an indication of wind only; and sometimes rise when the wind is to the north or east.

A north-east wind generally causes the Barometer to rise, and it is generally low, with a south-west wind.

An extraordinary fall of the mercury will sometimes take place in summer previous to heavy showers attended with thunder; but in spring, autumn, and winter, it indicates violent winds.

The mercury is higher in *Cold* than in *Warm Weather*; and lower at noon and midnight than at any other period of the day.

The mercury generally falls at the approach of the *New* and *Full Moon*; and rises at the *Quadratures*.

Before high tides, there is almost always a great fall of the mercury; this takes place oftener at the *Full* than at the *New Moon.*

The *greatest changes* of the Barometer commonly take place during clear weather, with a north wind; and the *smallest risings* during cloudy, rainy, or windy weather, with a south, or nearly south wind.

The words generally engraved on the plate of the Barometer rather serve to *mislead* than to *inform;* for the changes of weather depend rather on the rising and falling of the mercury, than on its standing at any particular height. When the mercury is as high as fair, and the surface of it is *concave*, beginning to descend, it very often rains; and on the contrary, when the mercury is opposite rain, when the surface of it is *convex*, beginning to rise, fair weather may be expected. These circumstances not being duly attended to, is the principal cause that many people have not a proper confidence in this instrument.

When the mercury stands in the Barometer at 30 inches, the *pressure* or *weight* of the air upon every square inch on the earth's surface is about 15 lbs. avoirdupois. Hence if we take the surface of a middle sized man to be 14 square feet; when the air is lightest, the pressure on him is about 13 tons, and when heaviest about 14 tons. The difference of 1 ton in the weight of the air at one time more than at another, must greatly effect us, in regard to the animal functions, and consequently in respect to our healths, more especially when the change takes place in a short time. When the Barometer rises, the weight of the air increases, the weather is commonly fine, and we feel ourselves what we call braced and more alert and active than usual; on the contrary, when the Barometer falls, the weight of the air diminishes, the weather is bad, and people feel a listlessness and inactivity hang about them. Hence we are enabled to correct an improper expression, which many people make use of when their spirits are depressed, by saying, that it proceeds from the heaviness of the air, whereas it arises from the contrary effect of it.

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THE
THERMOMETER.

THE Thermometer is used to measure the degrees of heat in the air, and contributes towards denoting when changes are likely to take place in the lower regions of the atmosphere. The Thermometer most in use is FAHRENHEIT'S, which is sometimes placed in the same frame with the Barometer. The scale affixed to it, is divided into equal parts, called degrees; of which the number between what is called the freezing and boiling water points is 180, the former being at 32, and the latter at 212, above 0, or the point from which the degrees are numbered above and below it. The following rules and directions are selected, as being the most useful, in applying this instrument to predict the changes which take place in the air, &c.

It is generally allowed, that the sensations of *Heat* and *Cold* are occasioned by the presence or absence, in degree, of a certain principle or quality, denominated *Fire* or *Heat.*

When any substance feels cold to the hand, it is concluded the principle of heat is not so abundant in that substance as in the hand; and if it feels hot, then more abundant.

One universal effect of fire, is its expanding or enlarging those bodies into which it enters; which bodies subside again when the fire is withdrawn.

Solids are least expanded by fire; *Inelastic Fluids*, as water, spirits &c. are more expanded; and *Elastic Fluids*, as air, most of all.

In Thermometers, the mercury with which they are filled, is found to *expand* nearly in proportion to the heat it receives; and to *contract* as it imparts it to the surrounding bodies. Hence the dilatations and contractions, or the rising and falling of the mercury, indicate the degrees of heat in the atmosphere, &c.

The extreme degrees of *Heat* are almost every where the same; this however, is not the case in regard to the same degrees of *Cold.*

The *Wind* has no influence on the Motions of the Thermometer; but *Moisture* has a peculiar influence on the Mercury, if followed by a wind which disperses it.

The *greatest Heat*, and the *greatest Cold*, in the atmosphere, takes place about 6 weeks after the longest and shortest days.

The Thermometer changes more in *Summer*, than in *Winter*.

The *coldest* period of the day is half an hour before sun-rise. And the *hottest* between 2 and 3 o'clock in the afternoon, in our latitude.

In *Winter*, if the cold diminishes suddenly, and in *Summer*, if the heat augments suddenly, it in general portends rain.

It scarcely ever *Freezes* in latitudes under 35 degrees; nor ever *hails* in latitudes higher than 60 degrees.

Between the latitudes of 35 and 60 degrees, in places adjacent to the sea, it generally *thaws*, when the Sun's altitude is 40 degrees; and seldom begins to *freeze*, until the Sun's meridian altitude is below 40 degrees.

January, in general, is the *coldest* month, in every latitude, and *July* the warmest, in all latitudes above 48 degrees, and *August* in all below it, in the Northern hemisphere.

Every habitable latitude enjoys a heat of 60 degrees at least for two months, which seems necessary for the growth and maturity of corn. The quickness of vegetation in the higher latitudes proceeds from the duration of the sun over the horizon for a considerable time without setting. Rain is but little wanted there, as the earth is sufficiently moistened by the liquefaction of the Snow, that covers it during the Winter.

When snow covers the earth, it tends to keep it warm: because, by its interposition, it prevents the cold air from taking the caloric, or heat, from the earth.

No substance in nature is found to deprive water of its Oxygen or pure air, with more avidity than fertile earth. Hence, when snow melts, it penetrates into the vegetable mould, and communicates to it, its Oxygen, by which means the earth's fertilizing power is increased, and the germination of seeds, the growth of plants, &c. are promoted.

A continuance of *cloudy* or *misty Weather* will intercept the Sun's rays from reaching the earth, and consequently prevent it from receiving its due proportion of heat to ripen the corn and fruit. This was the case during several of the summer months, in the year 1783, when the whole continent of Europe was covered with a fog, which is supposed to have proceeded from *Sicily* and *Calabria*, when that dreadful earthquake happened, which desolated some of the most beautiful and fertile provinces in Europe.

What

What follows is an account of some experiments made with the Thermometer, at the time that the Barometer stood at 29 inches, viz. *mercury* boils at 600 degrees; *cow's milk*, at 213; *water*, at 212; *brandy*, at 190; the heat of the *human body* in a common ague or fever, at 106; the heat of the *human body* in health, at 98; the *mean temperature* of the air in England, at 55; *water* just freezing, or *snow* and *ice* just melting, at 32; *milk freezes*, at 30; *vinegar*, at 28; *wine*, at 20; a mixture of *snow* and *salt* will sink the Thermometer to 0; *brandy freezes* at 7 degrees below 0; and *mercury*, it is thought, at 40 degrees below 0, a degree of cold, of which, in this country, we have no conception.

* * *

THE

HYGROMETER.

THE Hygrometer is an instrument intended to discover the moisture contained in the atmosphere, and to foretel a change in the weather. Whatever substance contracts by moisture, and lengthens by dryness, as cord, catgut, whale bone, &c. is capable of being formed into a Hygrometer; and that substance is to be preferred, whose expansion or contraction varies most nearly in proportion to the quantity of moisture imbibed.

From time immemorial, the effects of moisture have been considered as prognostic of the weather, as is evident by the confidence the house-wife places in her *Salt-box*, the carter in his *Whit-leather Thong*, and the sailor in his *Shrouds*. And the Hygrometer promises to be an instrument of no inconsiderable use to the farmer in hay-time and harveſt; which is fully evinced by the following observation of Mr. MARSHALL, in his minutes of agriculture, viz. "Yesterday morning (says he) while the Hygrometer stood at 2 degrees moist, the peas were by no means fit for carrying; the haulm was green, and the peas soft. About ten o'clock the Hygrometer fell to 1 degree dry; before one, the peas were in good order; I went up into the field, merely on the word of the Hygrometer, and found them fit to be carried." The following remarks and observations are selected, as likely to be the most useful on this subject.

◆

The Dutch Toys, called *Weather Houses*, are no bad Hygrometers for common purposes; the contraction of the string by moisture in the air, forces the man out of the door against *Bad Weather:* and when the air begins to be dry, the string is disposed to resume its natural length, and forces the woman out of the door against *Good Weather*.

A common Hygrometer may be made by suspending a piece of *Catgut*, *Whip-cord*, *Whit-leather*, &c. about 4 feet long from a nail, against a wall, with a leaden ball fixed to the other end: near which fix a scale on the wall, divided into several equal parts, to shew when the ball rises and falls. Then as the air becomes moist, the ball ascends, and we judge that rain is at hand: on the contrary when the air becomes dryer, the ball descends, and we judge that fine weather is approaching. But when great exactness is required in these matters, the whale-bone Hygrometer ought to be procured, which is esteemed one of the best.

The cold in the higher regions of the air, may be one cause why vapours are not collected so plentifully there, as nearer the earth; as the clouds are seldom found to be more than a mile in height, and not often at that elevation.

The height where the air is found to be most salubrious and proper for animal life, is between five and six hundred yards above the level of the sea. And the air at sea is esteemed more pure than that on the land.

A moist air conducts heat with much more rapidity than dry cold air; and the more that vapour is dilated, the more heat it absorbs. *Evaporation* is greatly increased by a current of air flowing over the evaporating surface. Hence a calm day is always hotter than one in which there is a strong wind. And hence arises, the danger of persons sitting in a current or draft of air, which robs him of his animal heat, and produces *colds* and *coughs*; the reason also is plain, why those disorders are more prevalent during the cold autumnal rains, and the breaking up of frost in the spring: and from the same cause arises the danger of sleeping in *damp beds, inhabiting damp houses, &c.*

Evaporation in our climate is four times greater from the 21st of March to the 21st of September, than in the remaining part of the year. Hence it is that the evening air in summer and autumn is more unhealthy, than the cold and severe frosts in winter.

Tracts of land covered with trees or vegetables, are found to emit more vapour than the same space covered with water. Hence the air about a wood or forest is made colder by the evaporation from the trees and shrubs, while the plants themselves are kept in a more moderate heat, and secured from the burning heat of the sun, by the vapours perspired from the leaves. And hence it is that we find the shade of trees more effectual to cool us, as well as more agreeable, than that from rocks and buildings.

It is generally allowed that clearing away wood, in time, lessens the vapours, and consequently the rain of a country. This appears to be the case in several fine parishes in *Jamaica*, which used to produce large crops of sugar canes; but upon clearing away the neighbouring woods, they are now dry for nine months in the year. And in those parts of America, where the woods have been cut down, it is well known that their humidity is very much lessened. Hence we may learn the necessity of preserving the trees, from beneath whose humid shades a water spring discharges its streams; and hence, too, we may learn, that the smallest springs may be improved by planting around them a grove of trees. On the other hand it may not be improper to observe, that thick plantations adjacent to houses which stand low, cannot be wholesome, on account of the increase of moisture and the bad air they emit during the absence of the sun.

The soil of large tracts of land has its share in influencing the temperature of the weather: thus stones or sand heat and cool more readily, and to a greater degree, than the earth or vegetable mould. Hence the violent heats of most sandy desarts, particularly those in Arabia and Africa, and the burning heat and blasting qualities of the wind that passes over them: hence also the intense cold of Terra-del-Fuego, and other stoney countries in cold latitudes.

The following positions have been deduced from some observations on the electrical state of the atmosphere, viz. that in the spring, when plants begin to grow, we are told that temporary electrical clouds begin to appear, and pour forth electric rain. And that the electricity of the clouds and of the rain increases, till that part of autumn, when the fruits are gathered. It is hence supposed to actuate and animate vegetation, and to give rain that power, which renders it more propitious to vegetables than any other kind of watering.

Spontaneous or insensible evaporation is not only carried on from the surface of the earth, but from all vegetables. A part of the water, thus raised into the air in the day, falls down again in *Dew* in the night; and is absorbed by the substances which yielded it before. Thus, the earth is not so soon exhausted of its moisture from a long drought, as we are apt to imagine; as may be proved by the following easy experiment made by the *Bishop of Landaff*, viz.

Having provided a large drinking glass, the area of the mouth of which was twenty square inches, he placed it with its mouth downwards on a grass plat which had been mown close. The sun shone bright and hot, and there had been no rain for upwards of a month. When the glass had stood on the grass-plat one quarter of an hour, and had collected a quantity of condensed vapour, he wiped its inside with a piece of muslin, the weight of which he had previously ascertained, and as soon as the glass was wiped dry, the muslin was weighed. The medium increase of weight from various experiments, between twelve and three o'clock, was six grains in one quarter of an hour from twenty square inches of earth. At this rate of evaporation, it is easy to calculate that not less than 1600 gallons of water would be raised from an acre of ground in twelve hours.

By the theory of spontaneous evaporation, many of the common appearances in nature are explained. If a glass of cold water, &c. be exposed in a room where many people are assembled, its outside will soon be covered with moisture like dew; which is produced by the cold body condensing the vapour with which the air is charged from the breath and perspiration of the company. Similar to this is the dew on the inside of the windows, which in cold weather is frequently frozen, and assumes the forms of leaves of trees, and of the most beautiful mosses.

The

THE RAIN-GAUGE.

THE *Rain-Guage*, or *Pluviameter*, is an instrument placed to receive the falling rain, with a view to ascertain the exact quantity that falls upon a given horizontal surface.

The Rain-Gauge is a very simple instrument, consisting of a square *tin funnel*, of 12 inches in diameter, communicating with a tube or cylinder of tin, into which the rain is conveyed by the funnel. The depth of the water is measured by a rule fixed to a float; this rule passes through the centre of the funnel. The divisions on the rule shew the number of cubic inches of water that have fallen, in a given time, on a surface of one square foot.

To use the Rain-Gauge, so much water should be first poured in, as will raise the float, so as the *Zero*, on the rule, may exactly coincide with the aperture of the funnel, which is so contrived as to prevent the water from evaporating. This instrument should be fixed down firmly in a place, where, whatever wind blows, the fall of the rain may not be interrupted by the houses, or any other impediment.

What follows is an account of the quantity of rain, which fell at London yearly, for seven years, taken from the Philosophical Transactions, viz. in the year 1774 the depth of rain which fell, was equal to $26\frac{3}{10}$ inches; in 1775 to 24 inches; in 1776 to $20\frac{3}{10}$ inches; in 1777 to $25\frac{3}{10}$ inches; in 1778 to $20\frac{8}{10}$ inches; in 1779 to $26\frac{8}{10}$ inches; and in 1780 to $17\frac{3}{10}$ inches: which at a medium is about 23 inches for each year.

It appears that the most rain falls in places near the sea coast, and less as the places become more inland. The quantity which falls on the western coast of England, is sometimes twice as much as falls at London. It is also found, that the nearer the Rain-Guage is placed to the ground, the more rain it collects.

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